

## **Supplementary Materials**

**(To accompany the manuscript *The use of connected digital products in clinical research following the COVID-19 pandemic: a comprehensive analysis of clinical trials*)**

### **Additional Details on Methods Used to Create and Validate Search Term Algorithm for Identification of Connected Digital Products**

Below is the complete set of the 140 search terms adapted from the list used in Marra, et al. 2020 to include additional terms related to telehealth delivery. These terms were used to identify a clinical trial as using a connected digital product (CDP). The research team used an automated algorithm to search for each term in several relevant ClinicalTrials.gov fields, such as “official title”, “brief summary”, “detailed description”, “interventions”, “study arms”, and “outcome measures.”

To confirm accuracy of the search algorithm, a random number generator was used to select 500 trials (250 from the pre-period and 250 from the post-period) for manual review. Of the 500 reviewed by the research team, 2 false positives were found, suggesting sensitivity of the search algorithm to be >99%. False positives were trials where a search term was found by the algorithm but manual review discovered that the CDP was not used to support remote monitoring or telehealth delivery. Within the 500 reviewed, there were also 4 false negatives identified, which were trials where the algorithm did not identify a CDP but manual review found one was used. This suggests algorithm specificity to be ~99%.

To alleviate incomplete data concerns arising from trial registration delays, we downloaded ClinicalTrials.gov records with trial start dates occurring between May 1, 2019 through February 28, 2021 from <https://aact.ctti-clinicaltrials.org/> on April 2, 2020, allowing 5 weeks for trial sponsors to retroactively register studies.

Search Term List:

1.	accucheck	31.	exercise bracelet	61.	ncapp
2.	actigraph	32.	facebook	62.	newsfeed
3.	activity monitor	33.	fall risk bracelet	63.	non-contact ecg
4.	aim covid-19 app	34.	fitbit	64.	online class
5.	amazon alexa	35.	freestyle libre	65.	online coaching
6.	app-based practice	36.	gamification	66.	online contact
7.	apple watch	37.	garmin	67.	online daily diary
8.	awareness bracelet	38.	google	68.	online exercise
9.	biosensor	39.	handheld manometer	69.	online fall detection system
10.	biovitals	40.	hand-held spirometer	70.	on-line forum
11.	brave program	41.	health app	71.	on-line group
12.	cct game	42.	hear glue ear app	72.	online intervention
13.	chat-based support	43.	holter monitor	73.	online learning
14.	collected online	44.	home pulse oximeter	74.	online meeting
15.	conducted entirely online	45.	hwa watch	75.	online mindfulness intervention
16.	continuous glucose monitor	46.	hydration sensor	76.	online platform
17.	covid-19 symptom tracker	47.	i-neb	77.	online questionnaire
18.	dexcom	48.	ICOPE App	78.	online self-administered questionnaire
19.	digital app	49.	intelligent pulse oximeter	79.	online self-completed questionnaire
20.	digital biomarker	50.	internet	80.	online support
21.	digital camera	51.	ipad	81.	online survey
22.	digital cardiac counseling	52.	iphone	82.	online trial
23.	digital counseling	53.	meditation app	83.	online yoga
24.	digital data collection	54.	mhealth	84.	phone app
25.	digital therapeutic	55.	mindfulness app	85.	phone call
26.	digital video camera	56.	minimed	86.	phone interview
27.	e-learning	57.	miro	87.	post online
28.	electronic data collection	58.	mobile app	88.	qualtrics
29.	electronic patient journal	59.	mobile device		
30.	electronic questionnaire	60.	movehero		

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|------|---------------------------------|------|----------------------------|
| 89.  | redcap                          | 120. | video chat                 |
| 90.  | reminder bracelet               | 121. | video communication        |
| 91.  | remote assessment               | 122. | video consultation         |
| 92.  | remote consultation             | 123. | video encounters           |
| 93.  | remote mindfulness session      | 124. | video observation          |
| 94.  | remote monitoring               | 125. | videoconferencing          |
| 95.  | secure electronic ecrf          | 126. | videophone call            |
| 96.  | skype                           | 127. | virtual check-in           |
| 97.  | sleep sense                     | 128. | virtual care at home       |
| 98.  | smart bracelet                  | 129. | virtual clinic             |
| 99.  | smart care vip bracelet         | 130. | virtual group intervention |
| 100. | smartpill                       | 131. | virtual reality            |
| 101. | smart tv                        | 132. | virtual visit              |
| 102. | smartphone                      | 133. | watchpat                   |
| 103. | smartwatch                      | 134. | wearable                   |
| 104. | social media                    | 135. | web-application            |
| 105. | stop touching your face program | 136. | web based                  |
| 106. | study website                   | 137. | webex                      |
| 107. | tablet-based game               | 138. | wechat                     |
| 108. | teleconference                  | 139. | whatsapp                   |
| 109. | teleconsultation                | 140. | zoom                       |
| 110. | telehealth                      |      |                            |
| 111. | telemedicine                    |      |                            |
| 112. | telephone                       |      |                            |
| 113. | telephone coaching              |      |                            |
| 114. | telerehabilitation              |      |                            |
| 115. | text message                    |      |                            |
| 116. | thermal sensor chip             |      |                            |
| 117. | vibrolung                       |      |                            |
| 118. | video-based                     |      |                            |
| 119. | video call                      |      |                            |

### Supplemental Analysis of Trials Conducted within the United States

As a robustness check, we removed trials conducted outside of the United States because the guidance encouraging virtual trials was issued by the U.S. FDA. We determine the trial location using the “location countries” field in the ClinicalTrials.gov record. Approximately 32% (15,627/49,482) of trials started during the study period (between May 1, 2019 and February 28, 2021; March & April 2020 excluded) had a U.S. site listed, 11% had no country listed, and the remaining 57% were conducted in other countries.

Though we find a somewhat higher rate of CDP adoption among U.S. trials (between 15.7-24.3% per month), the average increase in CDP usage among U.S. trials following the pandemic onset was the same as the average seen for all trials in the sample (a 1.7 percentage point increase from pre-period to post-period) [Figure 3].

